IES-2015 (14ᵗʰ June'15)

CIVIL ENGINEERING

Objective Paper-II (SET-B)

1.   Which one of the following Remote Sensing Systems employs only one detector?

   (A) Scanning   (B) Framing

   (C) Electromagnetic spectrum   (D) All of the above

Key: (A)

Exp: A scanning system employs a single detector with a narrow field of view that is swepth across the terrain to produce an image.

2.   The maximum superelevation to be provided on a road curve is 1 in 15. If the rate of change of superelevation is specified as 1 in 120 and the road width is 10m, then the minimum length of the transition curve on each end will be

   (A) 120m   (B) 100m   (C) 80m   (D) 180m

Key: (C)

Exp: $L = eNW = \dfrac{1}{15} \times 120 \times 10 = 80$

3.   A four- lane divided highway, with each carriageway being 7.0m wide, is to be constructed in a zone of high rainfall. In this stretch, the highway has a longitudinal slope of 3% and is provided a camber of 2%. What is the hydraulic gradient on this highway in this stretch?

   (A) 4.0%   (B) 3.6%   (C) 4.5%   (D) 3.0%

Key: (D)

Exp: The hydraulic gradient is equal to longitudinal slope i.e. 3%

4.   In an area of heavy rainfall, a State Highway of high-type bituminous surface with four lanes (14.0 m wide) is to be constructed. What will be the height of the crown of the road relative to the edges for a composite camber (i.e. middle half as parabolic and the rest as straight lines)?

   (A) 14 cm   (B) 21 cm   (C) 28 cm   (D) 7 cm

Key: (A)

Exp: Camber is 1 in 50

   $\text{Rise of crown} = \dfrac{1}{50} \times \dfrac{14}{2} \times 100 = 14 \text{ cm}$

5.   Consider the following statements:

(i) Effective stress in a sand layer below a lake with standing water does not alter as the water level fluctuates.

(ii) Regarding water table below the ground surface, any rise in the water table causes equal changes in both pore pressure and effective stress.

(iii) Capillary saturation will cause the effective stress to increase.

Which of the above statements are correct?

(A) 1, 2 and 3   (B) 1 and 2 only   (C) 2 and 3 only   (D) 2 and 3 only

Key: (A)

Exp: As it is completely submerged no change in effective stress. Due to capillary relative pressure developers.

6.   A descending gradient of 4% meets an ascending grade of 1 in 40 where a valley curve of length 200 m is to be formed. What will be the distance of the lowest point on the valley curve from its first tangent point?

(A) 100m   (B) 111m   (C) 125m   (D) 118m

Key: (B)

Exp: $\eta = -.04 - .025 = 0.065$

$X_0 = L\sqrt{n_1/2N}$

$= 200 \times \sqrt{0.04/2 \times 0.065}$

$= 111$

7.   What will be the non-passing sight distance on a highway for a design speed of 100 kmph when its ascending gradient is 2%? Assume coefficient of friction as 0.7 and brake efficiency as 50%.

(A) 176 m   (B) 200m   (C) 150m   (D) 185 m

Key: (A)

Exp: $f = \dfrac{0.7}{2} = 0.35$

$r = 27.77 \text{ m/sec}$

$vt + \dfrac{v^2}{2g(f \pm n)}$

$27.77 \times 2.5 + \dfrac{27.77^2}{2 \times 9.8 \times (0.35 + 0.02)}$

$= 176 \text{ m}$

8.   Consider the following statements:

(i) The ultimate bearing capacity of a footing on sand increases with an increase in its width.

(ii) The settlement of the footing on sand increases with increase in its width.

Which of the above statements are correct?

(A) 1 only   (B) Both 1 and 2   (C) 2 only   (D) Neither 1 nor 2

Key: (B)

Exp: (i) $\dfrac{q_f}{q_p} = \dfrac{B_f}{B_p}$

(ii) $\dfrac{S_t}{S_p} = \left(\dfrac{B_t\left(B_p + 0.3\right)}{B_p\left(B_f + 0.3\right)} \right)^2$

9.   The duration of green time in a traffic signal depends on

       (A) Traffic density   (B) Traffic volume

       (C) Traffic speed   (D) All of these

Key: (D)

Exp: More the traffic return in a large more time is required for queue clearance and hence more green time is required.

10.   What will be the theoretical maximum capacity (to nearest 10 units) for a single lane of highway given that the speed of the traffic stream is 40kmph?

       (A) 3000veh/h   (B) 2860 veh/h

       (C) 2010 veh/h   (D) 2510 veh/h

Key: (B)

Exp: $C = \dfrac{1000V}{S}$

$V = 40 \text{ kmph}$

$S = 0.278 \times Vt + 2 = 0.278 \times 40 \times 0.7 + 6.2 = 13.984$

$C = \dfrac{1000 \times 40}{13.984} = 2860 \text{ veh/hr}$

11.   The lowest height above the runway where the pilots make decision to continue the landing manoeuvre or to cut it short is called the

       (A) Runway height   (B) Decision height

       (C) Threshold height   (D) Runway visual range

12.   What would be the admissible gradient for a BG track when the grade resistance coupled with a 4° curve resistance shall equal the resistance due to a ruling gradient of 1 in 200?

       (A) 0.30%   (B) 0.40%   (C) 0.24%   (D) 0.34%

Key: (D)

Exp: Curve compensation = 4% × 4 = 0.16

Ruling gradient of 1 in $200 = \dfrac{1}{200} \times 100 = 0.5$

Available $= 0.5 - 0.16 = 0.34\%$

13. In the layout of an MG track, the versine of a horizontal circular curve is measured over a 11.8 m chord length. What would be the radius of the curve if the value of the versine was 2 cm?

(A) 900m   (B) 800m   (C) 870m   (D) 850m

Key: (B)

14. What will be the optimum depth of ballast cushion required for a BG railway track below the sleepers with sleeper density of (M + 5) and bottom width of 22.22 cm?

(A) 25cm   (B) 21cm   (C) 28cm   (D) 30cm

Key:

15. Which one of the following items of hill road construction does not help in prevention of landslides during the monsoon season?

(A) Breast walls   (B) Hair-pin bends
(C) Catch-water drains   (D) Retaining walls

16. The radius of a horizontal circular curve is 480 m and design speed therein 70kmph. What will be the equilibrium superelevation for the pressures on the inner and the outer wheels to be equal?

(A) 5%   (B) 6%   (C) 7%   (D) 8%

Key: (D)

Exp: $e = \dfrac{V^2}{127R} = \dfrac{70^2}{127 \times 480} = 8\%$

17. The runway length for an airport located at 460 m above MSL, corrected for elevation, is 3670 m. The monthly means of maximum and mean daily temperatures for the hottest month of the year are 27^OC and 18^OC, respectively. What will be the final corrected length of the runway with correction incorporated also due to temperature effects?

(A) 4500m   (B) 4000 m   (C) 3750 m   (D) 3400 m

18. The magnetic azimuth of one end of a runway is 80° measured clockwise from the magnetic north. The other end of the runway will be numbered as

(A) 16   (B) 24   (C) 26   (D) 8

Key: (C)

Exp: Magnetic azimuth = 26

19.   What will be the initial traffic after construction, in commercial vehicles per day (CVD) for the following data?

Annual average daily traffic at last count = 400 CVD

Rate of traffic growth per annum = 7%

The road is proposed to be completed in 3 years

(A) 500   (B) 421   (C) 490   (D) 449

Key: (C)

Exp: $CVD = 400\left(1 + \dfrac{7}{100}\right)^3 = 490$

20.   What shall be the radius of an exit taxiway with design exit speed of 90kmph and coefficient of friction 0.13?

(A) 550m   (B) 500m   (C) 475m   (D) 449m

Key: (B)

Exp: $R = \dfrac{V^2}{127P} = \dfrac{90^2}{127 \times 0.13} = 495$

21.   A ship has a metacentric height of 0.90 m and its period of rolling is 20 seconds. The relevant radius of gyration is nearly

(A) 5.5m   (B) 7.5m   (C) 9.5 m   (D) 11.5m

Key: (C)

Exp: $T = 2\pi\sqrt{\dfrac{k^2}{G\,m.g}} \Rightarrow 20 = 2\pi\sqrt{\dfrac{k^2}{9.81 \times 0.9}}$

$k = 9.459$

22.   A square gate, 1.5 m × 1.5 m, on one of the vertical sides of a fully filled water tank, has one side on the free water surface. It is hinged on the lower horizontal side and is held in position by a force applied on the vertical central line at a depth of 0.75m below the free surface. The right magnitude of this force is

(A) 500 × 9.81 N   (B) 600 × 9.81 N

(C) 750 × 9.81 N   (D) 1000 × 9.81 N

Key: (C)

23.   A certain water needs alum treatment to the extent of 10 p.p.m. How much alum, in quintals per day, would be needed to treat 10 MLD of water?

(A) 10   (B) 1.0   (C) 100   (D) 1000

Key: (B)

Exp: $10\,mg/l \times 10 \times 10^6 \, l/day = 100\,kg/day = 1\,quintal/day$

24. The surface tension in a soap bubble of 50 mm diameter with its inside pressure being 2.5 N/m^2 above the atmospheric pressure is

(A) 0.0125 N/m

(B) 0.0156 N/m

(C) 0.2 N/m

(D) 0.0312 N/m

Key: (B)

Exp: $\sigma = \dfrac{pd}{8} = \dfrac{2.5 \times 0.005}{8} = 0.0156 \text{ N/m}$

25. A mercury water manometer has a gauge difference of 0.8m. The difference in pressure measured in metres of water is

(A) 0.8   (B) 1.06   (C) 10.05   (D) 8.02

Key: (C)

Exp: $h_w = h_m\left(\dfrac{P_m}{P_w} - 1\right) = 0.8\left(\dfrac{13.6}{1} - 1\right) = 10.08\text{m}$

26. A sphere is moving in water with a velocity of 1.6 m/s. Another sphere of twice the diameter is placed in a wind tunnel and tested with air which is 750 times less dense and 60 times less viscous (dynamically) than water. The velocity of air that will model dynamically similar conditions is

(A) 5 m/s   (B) 20 m/s   (C) 10 m/s   (D) 40 m/s

Key: (B)

Exp: $\left(\dfrac{pvd}{\mu}\right)_m = \left(\dfrac{pvd}{\mu}\right)_p$

$V = 10 \text{ m/s}$

27. The flow in a river is 1500 cumecs. A distorted model is built with horizontal scale of $\dfrac{1}{150}$ and vertical scale of $\dfrac{1}{25}$. The flow rate in the model should be

(A) $0.04\,\text{m}^3\,\text{s}^{-1}$ (B) $0.06\,\text{m}^3\,\text{s}^{-1}$ (C) $0.08\,\text{m}^3\,\text{s}^{-1}$ (D) $0.10\,\text{m}^3\,\text{s}^{-1}$

Key: (C)

Exp: $Q_r = L_H L_r^{\frac{3}{2}}$

$\dfrac{1500}{Q_m} = 150(25)^{\frac{3}{2}} \Rightarrow Q_m = 0.08 \text{ m}^3/\text{s}$

28. 10 MLD water is to be chlorinated in a clear water reservoir (CWR) with 0.8 mg/l chlorine dose with providing contact time of 40 minutes. The required CWR capacity is nearly

(A) 220m^3 (B) 280m^3 (C) 28m^3 (D) 22m^3

Key: (B)

Exp: CWR capacity $= \dfrac{0.8 \times 10}{40} \times 60 \times 24 \text{ m}^3$

$= 288 \text{ m}^3 \approx 280 \text{m}^3$

29. The head over a V-notch at the end of a channel is 75 cm. If an error of 0.15cm is possible in the measurement of the head, then the percentage error in computing the discharge is

(A) 0.25   (B) 0.5   (C) 0.75   (D) 1.0

Key: (B)

Exp: $\dfrac{d\theta}{\theta} = \dfrac{5}{2}\dfrac{dH}{H} \Rightarrow \dfrac{5}{2} \times \dfrac{0.15}{75} = 0.5\%$

30. At a hydraulic jump, the depths at its two sides are 0.3 m and 1.2m. The head loss in the jump is

(A) 1.0m   (B) 0.8m   (C) 0.5m   (D) 0.45 m

Key: (C)

Exp: $E_L = \dfrac{(y_2 - y_1)^3}{4 \times y_1 \times y_2} = \dfrac{(1.2 - 0.3)^2}{4 \times 1.2 \times 0.3} = 0.5\text{m}$

31. Field observations are carried out to assess the discharge of river. Measurements are taken in a 2000 m straight reach. Slope is approximately 1 in 4000. Bed slope is determinable to a possible accuracy of 0.4 cm; wetted perimeter is determinable within 4% of possible error, and sectional area within 6% of possible error. Using Chezy's equation, the assessed discharge will be accurate to within

(A) 9.6%   (B) 10.8%   (C) 11.4%   (D) 12.7%

Key: (D)

32. Consider the following statements in respect of cast iron pipes employed for water supply:

(i) Easy to make joints

(ii) Strong and durable

(iii) Corrosion resistance

(iv) Long life

Which of the above statements are correct?

(A) 1, 2 and 3 only   (B) 1, 3 and 4 only

(C) 2, 3 and 4 only   (D) 1, 2, 3 and 4

Key: (D)

33. In turbulent flows through rough pipes, the ratio of the maximum velocity to the mean velocity is

(A) 2

(B) $\dfrac{4}{3}$

(C) 1.1

(D) Dependent on the friction factor

Key: (D)

34. Two reservoirs are connected by two pipes P and Q. The pipes have the same diameter and length and are placed in parallel. If the friction factor of P is 9 times that of Q, then the discharge in P to that in Q is

(A) 0.5   (B) 0.45   (C) 0.33   (D) 0.27

Key: (C)

Exp:
$h_f = FLV^2$
$Q = AV \Rightarrow P = 0.33Q$

35. A sludge had 100m3 volume when its moisture content was 95%. What would be its volume if its moisture content changed to 90%?

(A) $200m^3$ (B) $50m^3$ (C) $94.7m^3$ (D) $105.5m^3$

Key: (B)

Exp: $Volume = \dfrac{100 - 95}{100 - 90} \times 100 = 50\,m^3$

36. The Sludge Volume Index for mixed liquor having suspended solids concentration of 2000 mg/l and showing a settled volume of 200 ml from a one litre sample would be

(A) 0.1   (B) 1000   (C) 100   (D) 10

Key: (A)

Exp: $SVI = \dfrac{200\,mg/l}{2000\,mg/l} = 0.1$

37. The number of impellers required for a multistage pump to lift 4500 litres/minute against a total head 190m at a speed of 750 rpm with specific speed not to exceed 700 is

(A) 6   (B) 8   (C) 10   (D) 12

Key: (D)

38. A hydraulic turbine has an output of 6000 kW when it works under a head of 25 m and runs at 100 rpm. Then the type of turbine used is

(A) Pelton wheel   (B) Francis

(C) Kaplan   (D) Propeller

Key: (C)

Exp: $N_s = \dfrac{N\sqrt{P}}{H^{5/4}} = \dfrac{100\sqrt{6000}}{25^{5/4}}$

$= 138.25 \approx$ frames

39. The velocity heads of water at the inlet and outlet sections of a draft tube are 3.0 m and 0.20m, respectively. The frictional and other losses in the draft tube are 0.4m. What is the efficiency of the draft tube?

   (A) 15%   (B) 67%   (C) 86%   (D) 92%

Key: (C)

40. Consider the following statements regarding valves in a pipe line:

   (i) In log pipe lines, air will accumulate in the low point of the line and will interfere with flow.

   (ii) Pressure relief valves are used in pipe lines where pressure may increase beyond the maximum permissible pressure.

   (iii) Non-return valves prevent water flowing back, i.e., in the opposite direction

   Which of the above statements are correct?

   (A) 1 and 2 only   (B) 2 and 3 only

   (C) 1 and 3 only   (D) 1, 2 and 3

Key: (B)

41. The time taken to construct a building was from April 1992 to September 1993. In September 1996, the average settlement was found to be 5.16 cm. If the ultimate settlement is estimated to be 25 cm, then the settlement in January 1997 would have been

   (A) 6cm   (B) 7cm   (C) 8cm   (D) 9cm

Key: (A)

42. Consider the following statements:

   (i) The proportioning of footing in sand is more often governed by settlement rather than by bearing capacity.

   (ii) The pressure bulb profiles under a strip footing form as co-axially imaginable bulbs under its length.

   (iii) Friction piles are also called 'floating piles'

   Which of the above statements are correct?

   (A) 1, 2 and 3   (B) 1 and 2 only   (C) 1 and 3 only   (D) 2 and 3 only

Key: (A)

43. Which of the following factors affect the bearing capacity of cohesive soils?

   (i) Density of the soil

(ii) Angle of shearing resistance of the soil

(iii) Depth of the footing

(iv) Width of the footing

(A) 1,2 and 3 only   (B) 1,2 and 4 only

(C) 2,3 and 4 only   (D) 1,2,3 and 4

Key: (A)

Exp: It doesn't depend on width of footing for cohesive soil $N_r = 0 \Rightarrow 0.58\, N_r = 0$

44. Consider the following statements:

(i) The required yield of a retaining wall to reach equilibrium in the active case is less than for the passive case.

(ii) The active pressure caused by a cohesionless backfill on a smooth vertical retaining wall may be reduced by compacting the backfill.

(iii) Given a choice, one should prefer a cohesive soil for a backfill vis-à-vis a non-cohesive soil.

Which of the above statements are correct?

(A) 1,2 and 3 only   (B) 1 and 2 only

(C) 1 and 3 only   (D) 2 and 3 only

Key: (B)

Exp: Statement '3' is not correct because the cohesive soil should not be behind retaining wall as it will occur tension.

45. Consider the following statements:

Problems regarding foundations to be constructed in expansive soils are solved by

(i) Resorting to light foundation pressure

(ii) Using under – reamed piles for light loads

(iii) Making the structure rigid enough so that settlement and uplift would not affect them

(iv) Providing a well-designed basement with the foundation below the neutral point

Which of the above statements are correct?

(A) 1 and 2   (B) 2 and 4   (C) 1 and 3   (D) 2 and 3

Key: (B)

46. Which of the following tests are essential for designing a foundation on expansive soils?

(i) Swelling pressure test

(ii) Free swell test

(iii) Estimation of differential free swell

(iv) Shrinkage limit test

(A) 1,2 and 3 only   (B) 1,2 and 4 only

(C) 1,2,3 and 4   (D) 2,3 and 4 only

Key: (C)

Exp: All the tests should perform.

47. Consider the following statements:

The general principles of surveying are

(i) To work from part to whole

(ii) To locate a new station by measurements from at least two fixed reference points already established and/or identifiable

Which of the above statements is/are correct?

(A) 1 only   (B) 2 only   (C) Both 1 and 2   (D) Neither 1 nor 2

Key: (B)

Exp: Surveying work from whole to part.

48. Consider the following statements:

(i) Dynamic resistance of a soil is not much different from its static resistance

(ii) The most comprehensive pile driving formula is Hiley's formula

(iii) Pile driving formulae are more useful if the subsoil consists of coarse grained soils

Which of the above statements are correct?

(A) 1 and 2 only   (B) 1 and 3 only

(C) 2 and 3 only   (D) 1,2 and 3

Key: (C)

49. The Whole Circle Bearing of line AB is 50° and of line BC is 120°. The defection angle at B from AB to BC is

(A) 50° (B) 70° (C) 110° (D) 120°

Key: (B)

Exp: Deflection angle $= 120^o - 50^o$

$$= 70^o$$

50. The levelling staff held at a distance of 200 m is read at 4.54 m with the bubble out of centre by 2 divisions towards the observer. If the sensitiveness of the bubble is 25 secs/division, and 1 division = 2 mm, then actual staff reading must have been

(A) 4.5m   (B) 4.492 m   (C) 4.54m   (D) 4.62 m

Key: (B)

Exp: $\alpha = \dfrac{s}{nd} \times 206265$

$25 = \dfrac{s}{2 \times 200} \times 206265$

$s = \dfrac{25 \times 2 \times 200}{206265} \Rightarrow 0.0484$

Staff reading $= 4.54 - 0.0489 = 4.492$ m

51. In a leveling survey, the summation of all back sights and the summation of all foresights are 7.475 and 7.395 m, respectively. The reduced level of the initial benchmark is 100.000 m. The reduced level of the last point where the staff is held will be

(A) 100.000 m   (B) 100.080 m   (C) 107.395m   (D) 107.475 m

Key: (B)

Exp: Reduced level of benchmark - reduced level of last point

$EFS - EBS = 100 + 7.475 - 7.395 = 100.08$

52. Consider the following statements regarding excreta disposal without water carriage system:

(i) Pit-Privy is a pit in the ground with the toilet seat located directly over it.

(ii) Bore-Hole Latrines do not cause nuisance due to files and odour.

(iii) Aqua-Privy works on the same principle as septic tank.

(iv) In the context of a Bore-Hole Latrine, a pit of about 30 cm to 40 cm diameter is dug to a depth of 4m to 8m.

Which of the above statements are correct?

(A) 1,2 and 3 only   (B) 2 and 4 only

(C) 1,3 and 4 only   (D) 1,2,3 and 4

53. Which of the following minor instruments are used for setting out right angles in chain surveying?

(i) Cross staff

(ii) Optical square

(iii) Prism square

(iv) Auto level

(A) 1 and 2 only   (B) 2 and 3 only

(C) 1,2 and 3   (D) 2,3 and 4 only

Key: (C)

Exp: Cross shaft, optical square and prism square all helps to set out right angle.

54. Regarding a Prismatic Compass, which one of the following statements is correct?

    (A) The object is sighted first. The observer then moves to the side of the object vane to take the reading

    (B) Sighting and reading and done simultaneously

    (C) The readings are taken from the north end

    (D) The compass has an edge bar needle

Key: (B)

Exp: Sighting of an object and reading of the bearing are done simultaneously.

55. With regard to Trigonometric Levelling, which one of the following statements is correct at its simplest applications?

    (A) Determination of the elevations of stations is based on the observed vertical angles and the horizontal distances

    (B) Determination of the horizontal distances is based on the observed vertical angles

    (C) Determination of the vertical angles is based on the observed horizontal distances

    (D) Determination of the horizontal distances is based on the observed vertical angles and the measured elevations

Key: (A)

Exp: Leveling is done to determine elevation of station based on observed vertical angle.

56. Consider the following statements:

    (i) The component of the distance between two points measured in the north-south direction is called the latitude of the line, between the points

    (ii) The component of the distance between two points measured in the east-west direction is called the departure of the line, between the points

    (iii) The latitude is considered as positive when reckoned southward

    (iv) The departure is considered as negative when reckoned westward

    Which of the above statements are correct?

    (A) 1,2 and 3 only   (B) 2,3 and 4 only

    (C) 1,2 and 4 only   (D) 1,2,3 and 4

Key: (C)

57. For minor adjustments of horizontal angles measured using a theodolite, the tangential screw is adjusted after

    (A) Both the plates are unclamped

    (B) The lower plate is clamped and the upper plate is unclamped

    (C) The upper plate is clamped and the lower plate is unclamped

    (D) Both the plates are clamped

58. Consider the following statements regarding ecology:

(i) Climax ecosystem is a stage in the evolution of an ecosystem, at which all the species are in dynamic equilibrium among themselves as also with the environment

(ii) Ecological niche means all the physical, chemical and biological factors that a species needs in order to live and reproduce exist

(iii) Edge effect refers to the presence of rich and unique biological diversity found in an ecotone.

Which of the above statements are correct?

(A) 1,2 and 3

(B) 1 and 2 only

(C) 1 and 3 only

(D) 2 and 3 only

59. For better accuracy in measuring and plotting the sides of a triangle by triangulation, the angles of the triangle

(A) Should not be more than 30°

(B) Should not be less than 30° or more than 120°

(C) are not restricted in magnitude

(D) Should not be less than 120°

Key: (B)

Exp: In Triangulation, a role of triangle (well conditioned triangle) should be more than 30°, less than 120°.

60. To uniquely determine the position of the user using GPS, one needs to receive signals from at least

(A) 1 satellite   (B) 2 satellite   (C) 3 satellite   (D) 4 satellite

Key: (D)

Exp: Minimum number of satellites=4

61. A 4 – hour rainfall in a catchment of 250 km^2 produces rainfall depths of 6.2 cm and 5 cm in successive 2 – hour unit periods. Assuming the φ index of the soil to be 1.2 cm/hour, the runoff volume is

(A) 1.6 ha-m   (B) 16 ha-m   (C) 160 ha-m   (D) 1600 ha-m

Key: (D)

Exp: Runoff depth=$\dfrac{6.2+5.0-(1.2\times4)}{}$

$=6.4cm$

Runoff volume$=250\times10^6\times6.4\times10^{-2}\times10^{-4}$ ha-m

$=1600$ ha-m

62. Return Period Refers to

(A) The Probability of Exceedance of an event

✦ ICP–Intensive Classroom Program ✦ eGATE-Live Internet Based Classes✦ DLP ✦ TarGATE-All India Test Series
❖India's No.1 institute for GATE Training ❖ 65+ Centers across India
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(B) The probability of Non – Exceedance of an event

(C) The inverse of the Probability of Exceedance of an event

(D) The Inverse of the Probability of Non-Exceedance of an event

Key: (C)

Exp: $T = \dfrac{1}{P}$ where p=probability of exceedance o an event.

63.   Orographic rain occurs when the air is cooled sufficiently as a result of

(A) Lifting due to flow over a mountain barrier

(B) Relative movement of two large air masses

(C) Violent upthrow of air arising from localized heating

(D) cyclonic conditions

Key: (A)

Exp: Orthographic rain $\rightarrow$ due mountain barrier

Convective rain $\rightarrow$ due to temperature difference

Cyclonic rain $\rightarrow$ due pressure difference

64.   A Double-Mass-Curve Analysis is useful in

(A) Consistency Analysis

(B) Frequency Analysis

(C) Storage Computation Analysis

(D) Guessing missing data in cases of non-homogeneous terrain

Key: (A)

Exp: Double mass curve $\rightarrow$ consistency of rainfall

65.   Consider the following steps which are involved in arriving at a unit hydrograph:

(i) Separation of base flow

(ii) Estimating the surface runoff in volume

(iii) Estimating the surface runoff in depth

(iv) Dividing surface runoff ordinate by depth of runoff

Which of the correct sequence of these steps?

(A) 4,3,2 and 1   (B) 1,2,3 and 4

(C) 4,2,3 and 1   (D) 1,3,2 and 4

Key: (B)

66.   Probability of a 10-year flood to occur at least once in the next 5 years is

(A) 35%   (B) 40%   (C) 50%   (D) 65%

Key: (B)

Exp:

$$R = 1 - 1\left(1 - \frac{1}{T}\right)^n$$

$$= 1 - 1\left(1 - \frac{1}{10}\right)^5 = 40.9\%$$

67.   S-curve Hydrograph is the hydrograph

     (A) Producing 1 cm of runoff over the basin

     (B) of flow from a 1cm intensity rain of infinite duration

     (C) having a volume of 1 cm^3

     (D) of the total storm duration in any single storm rainfall

Key: (B)

Exp: It so far infinite duration.

68.   Surface Runoff represents the total water

     (A) flowing in surface channels after the rainfall

     (B) obtained after deducting from rainfall water what has infiltrated and/or evaporated, from the total rainfall

     (C) excluding the base flow in surface channels after the rainfall

     (D) flown (or flowing) through all channels over a specified period of time

Key: (B)

69.   Consumptive Use refers to the loss of water as a result of

     (A) Evaporation and Transpiration

     (B) Crop Water Requirements

     (C) Evaporation and Infiltration

     (D) Evaporation and Transpiration from the cropped area

Key: (D)

70.   In a uniform semi-infinite aquifer, the dependable discharge of a lone circular open well is increased most easily by

     (A) increasing the diameter

     (B) making it into one with a square kerb

     (C) deepening the well

     (D) Providing coarser screening filter

71.   In a ski-jump bucket provided in an overflow spillway, the lip angle is 30°, and the actual velocity of flow entering the bucket is 30 ms. The maximum vertical height attained by the trajectory of the jet, measured above the lip of the bucket, is nearly

(A) 45m   (B) 35m   (C) 22m   (D) 11m

Key: (D)

Exp: Vertical component velocity at O = 0

V sin30^O-gt=0

$$t = \frac{v\sin30^o}{g}$$

h=vsin30^O.t-1/2gt^2

$$h = \frac{v^2\sin30^o}{2g}$$

$$= \frac{(30)^2 \times \frac{1}{4}}{2 \times 9.81} = 11.47m$$

72. The discharge capacity required at the outlet to irrigate 3000 ha of sugarcane having a kor depth of 173 mm and a kor period of 30 days is

(A) 2.0 m^3/s   (B) 1.0 m^3/s   (C) 20 m^3/s   (D) 0.20 m^3/s

Key: (A)

73. By considering the channel index as $\frac{5}{3}$, the setting of an orifice type irrigation outlet to have proportionality is

(A) 0.90   (B) 0.67   (C) 0.30   (D) 0.30

Key: (C)

74. What is the strainer length required for a deep tube well giving a discharge of 8 litres per second? Assume permissible entrance velocity of 2 cm/second. It is desired to have the strainer of slot sizes 20mm × 0.2 mm with number of slots per cm length of the strainer as 100.

(A) 8m   (B) 1m   (C) 12m   (D) 10m

Key: (D)

75. The population of a city in the year 2000 was 82,300. If average per cent increase in population per decade is 35%, the population of the city in the year 2020 estimated geometrical increase will nearly be

(A) 1,00,000   (B) 1,25,000   (C) 1,50,000   (D) 1,75,000

Key: (C)

Exp: Per decade, $x = 0.35$

$P_{2010} = 82300 \times (1 + 0.35)$

$P_{2020} = P_{2010} \times (1 + 0.35) = 1,50,000$

76.   The different actions that take place in anaerobic decomposition process are

(i) Alkaline fermentation

(ii) Acid fermentation

(iii) Acid regression

(iv) Methane formation

What is the correct sequence of these actions (from earlier to later)?

(A) 4, 3, 1 and 2   (B) 2, 3, 1 and 4

(C) 4, 1, 3 and 2   (D) 2, 1, 3 and 4

Key: (B)

77.   What is the rapid sand filter surface area required for filtering of 10 MLD water assuming a filtration rate of 100,000 l/m^2/day?

(A) 100m^2 (B) 10m^2 (C) 1m^2 (D) 1000m^2

Key: (A)

Exp: Area required $= \dfrac{10 \times 10^6}{100,000} = 100 \text{ m}^2$

78.   Consider the following statements in respect of slow sand filter and rapid sand filter:

(i) The two filters differ in respect of the standards regarding non-uniformity of the sand used in their filtering media.

(ii) The two filters do not differ in respect of the effective size of the sand used in them.

(iii) The two filters differ in respect of their respective under-drainage system.

(iv) The two filters differ in respect of their respective rate of filtration

Which of the above statements are correct?

(A) 1,2 and 3   (B) 1,2 and 4   (C) 2,3 and 4   (D) 1,3 and 4

Key: (D)

79.   How many kg of bleaching power is needed per day to chlorinate 4 MLD f water so that, after 40 minutes of contact, there remains residual chlorine of 0.25 mg/l. The input water has a chlorine demand of 1.25 mg/l, and that the bleaching powder has only 25% available chlorine.

(A) 8kg   (B) 20kg   (C) 24kg   (D) 6.6kg

Key: (C)

Exp: Bleaching powder required $= \dfrac{(1.25 - 0.25) \times 4}{0.25} \times \dfrac{60}{40}$

$= 24 \text{ kg}$

80. Which of the following help to prevent water pollution due to land-disposal of waste?

(i) Proper consolidation of waster to reduce pore space and permeability

(ii) Disposal over impervious strata

(iii) Layer of impervious soil on the top and the sides of the deposited solid waste

(A) 1 and 2 only   (B) 1 and 3 only

(C) 1,2 and 3 only   (D) 2 and 3 only

Directions:

Each of the next **Twenty (20)** items consists of two statements, one labelled as the 'Statement (I)' and the other as 'Statement (II)'.Examine these two statements carefully and select the answers to these items using the codes below:

Codes:

(A)   Both statement (I) and statement (II) are individually true and statement (II) is the correct explanation of statement (I)

(B)   Both statement (I) and statement (II) are individually true but statement (II) is not the correct explanation of statement (I)

(C) Statement (I) is true but Statement (II) is a false

(D) Statement (I) is false but Statement (II) is true

Key: (C)

81. Statement (I) : Open channel flow in a channel is said to be critical when the specific force is maximum for a given discharge.

Statement (II): Direct integration for steady non-uniform flow by Bresse's method was developed for very wide rectangular channels.

Key: (D)

82. Statement (I)   : A moving hydraulic jump is called a surge.

Statement (II): the travel of a wave is faster in the upper portion than in the lower portion in case of positive surges.

Key: (B)

83. Statement (I): Total energy line and the hydraulic gradient line for a pipe flow cannot intersect each other

Statement (II): The vertical differences between these two lines must equal the velocity head.

Key: (A)

84. Statement (I): In a reciprocating pump, the piston is considered to be moving with simple harmonic motion on the assumption that the connecting rod is very large compared to the crank length.

    Statement (II): There is acceleration at the beginning and retardation at the end of each stroke.

Key: (B)

85. Statement (I): Possibility of cavitation is an important consideration in the selection of a turbine for a given head and a range of corresponding specific speed.

    Statement (II): High – speed turbines are used for high heads.

Key: (C)

86. Statement (I): By providing Air Vessels on the suction and delivery sides of a reciprocating pump, it is possible to increase the delivery head of the pump.

    Statement (II): The Air Vessel terminates the acceleration head and contributes to the outgoing discharging becoming reasonably steady and uniform.

Key: (D)

87. Statement (I): If the soil moisture is only slightly more than the wilting coefficient, the plant must expend extra energy to obtain the water; and hence the plant will not grow healthily.

    Statement (II): Excessive water supply retards plant growth.

88. Statement (I): Dracontiasis is transmitted by drinking contaminated water

    Statement (II): Dracontiasis can be controlled by filtration of the drinking water.

89. Statement (I): Coagulation is the process of charge neutralization on colloids

    Statement (II): Flocculation is the process to grow the chargeless colloids into settleable flocs.

Key: (B)

90. Statement (I): The flow in water distribution pipes takes place due to gravity.

    Statement (II): The flow in sewers takes place due gravity.

Key: (D)

91. Statement (I): Anaerobic digestion of sewage is unsuitable in the vicinity of a crowded locality.

    Statement (II): Aerobic digestion of sewage is costly but is suitable at a crowded locality.

Key: (B)

92.   Statement (I): Duty of drip irrigation is very high

        Statement (II): Losses are least in drip irrigation.

Key: (A)

93.   Statement (I): An alluvial channel is defined as a channel in which the flow transports sediment of the same physical characteristics as the material in the wetted surface of the channel.

        Statement (II): This ensures that the channel cross-section and the channel slope do not change

Key: (C)

94.   Statement (I): The excavation of side slope of an irrigation canal for clayey type of soil should be made at 1 : 1 (i.e. 1 horizontal to 1 vertical) which is taken as nearly equal to the angle of internal friction of the soil.

        Statement (II): The angle of internal friction represents the stable slope when the excavated soil, or soil in loose conditions, assumes when dumped in situ.

Key: (D)

95.   Statement (I): Composting is basically a treatment method for inorganic waste from a community.

        Statement (II): In the incineration method of refuse disposal, the refuse is burnt off and the volume is much reduced.

Key: (D)

96.   Statement (I): Gases are normally formless fluids and can be changed to liquid or solid states by change of temperature and pressure

        Statement (II): Smog refers to the occurrence of a heavy, cloudy, hazy floating layer in the atmosphere formed by a mixture of smoke, dust, fog and mist.

Key: (B)

97.   Statement (I): The specific speed (N_S) of a centrifugal pump is defined as the speed (in rpm) at which it works most efficiently

        Statement (II): The specific speed is a characteristic of pumps that can be used as a basis for comparing the performance of centrifugal pumps.

Key: (D)

98.   Statement (I): Permanent lowering of ground water table results in settlement of foundations.

        Statement (II): Increase in effective stress does not result in settlement of strata.

Key: (C)

99. Statement (I): Boussinesq equation is not suitable for sedimentary deposits,

Statement (II): Sedimentary deposits do not represent an isotropic-cum- homogeneous system.

Key: (A)

100. Statement (I): In cohesive soils, the ultimate bearing capacity is independent of foundation width.

Statement (II): The ultimate bearing capacity of cohesive soils increases with depth below ground level.

Key: (C)

101. Consider the following statements in respect of electrostatic precipitators:

(i) Power requirement is very small compared to other air pollution control devices and so they are cheaper to perform than other devices.

(ii) Can handle both gases and mists for high volume flow.

(iii) Very small particles can be collected, either wet or dry.

Which of the above statements are correct?

(A) 1 and 2 only   (B) 2 and 3 only

(C) 1 and 3 only   (D) 1,2 and 3

Key: (D)

102. Consider the following statements:

(i) Ammonia nitrogen is a measure of nitrogen present as ammonium hydroxide and ammonium salts. It will progressively decrease as sewage gets treated.

(ii) Organic nitrogen is the total nitrogenous matter in sewage excepting that present as ammonia nitrogen, nitrites and nitrates. It becomes ammonia in anaerobic decomposition and nitrites or nitrates in aerobic decomposition.

Which of the above statements is/are correct?

(A) 1 only   (B) Both 1 and 2   (C) 2 only   (D) Neither 1 nor 2

Key: (B)

103. What is the required plan size of a square sedimentation tank (as the primary sedimentation tank in sewage treatment), given that its effective dept is 3m, and the flow rate is 40 MLD with admissible surface loading of 100,000 l/m^2/day?

(A) $23.5\,m \times 23.5\,m$ (B) $30\,m \times 30\,m$

(C) $20m \times 20\,m$ (D) $15m \times 15\,m$

Key: (C)

Exp: Area of tank $= \dfrac{40 \times 10^6}{1,00,000} = 400 \text{ m}^2$

So, $20 \text{ m} \times 20 \text{ m size}$

104. Consider the following statements related to ozone:

(i) Tropospheric ozone is harmful

(ii) Stratospheric ozone is beneficial

(iii) During prevalence of photochemical smog, O_3 is formed

Which of the above statements are correct?

(A) 1,2 and 3   (B) 1 and 2 only   (C) 1 and 3 only   (D) 2 and 3 only

Key: (A)

Exp: Stratospheric ozone protects us from harmful UV radiations. So, it is beneficial

. $NO_X +$ Unburnt hydraulic $\rightarrow$ Smog (O_3, CO)

105. Consider the following statements related to noise:

(i) The range of sound power and sound pressures produced is from 0.0002μ bars to 10000 μ bars.

(ii) Human ears do not respond linearly to increase in sound pressures.

(iii) Regular exposure to moderate noise makes the human ear more resistant to occasional exposures of high-intensity noise.

Which of the above statements are correct?

(A) 1 and 2 only   (B) 1 and 3 only

(C) 2 and 3 only   (D) 1,2 and 3

Key: (D)

106. Consider the following statements in respect of effect of air pollutants on vegetation:

(i) Necrosis refers to killing of tissue

(ii) Chlorosis refers to loss or reduction of green plant pigment

(iii) Leaf abscission refers to the dropping of leaves

(iv) Leaf epinasty refers to a downward curvature of a leaf due to a higher rate of growth on the upper surface

Which of the above statements are correct?

(A) 1 ,2 and 3 only   (B) 1 ,2,3 and 4

(C) 2,3 and 4 only   (D) 1,2, and 4 only

107. A soil deposit has a void ratio of 1.0 If the void ratio is reduced to 0.60 by compaction, the percentage volume loss is

(A) 10%   (B) 20%   (C) 30%   (D) 40%

Key: (B)

Exp:
$$\frac{\Delta H}{H} = \frac{\Delta e}{He_o}$$

$$\Rightarrow \frac{\Delta V}{V} = \frac{\Delta H}{H} = \frac{\Delta e}{1+e_o} = \frac{1-0.6}{1+1} = \frac{0.4}{2} = 0.2$$

So, %change in volume=20%

108. The specific gravity of a soil sample is 2.7 and its void ratio is 0.945. When it is fully saturated, the moisture content of the soil will be

   (A) 25%   (B) 30%   (C) 35%   (D) 40%

Key: (C)

Exp: $G_S = 2.7$; $es = WG$

$$W = \frac{0.945 \times 1}{2.7} = 0.35$$

109. If the co-efficient of permeability is doubled and the co-efficient of volume compressibility is simultaneously halved, the co-efficient of consolidation

   (A) Increases by 2 times   (B) Decreases by 2 times

   (C) Increases by 4 times   (D) Decreases by 4 times

Key: (C)

Exp: $cv = \dfrac{k}{m_v y_w}$

$$\Rightarrow \frac{cv_1}{cv_2} = \frac{k_1}{mv_1} \times \frac{mv_2}{k_2}$$

$$\Rightarrow \frac{cv_1}{cv_2} = \frac{k_1}{2k_1} \times \frac{mv_1/2}{mv_1}$$

$$\Rightarrow cv_2 = 4cv_1$$

110. Consider the following statements:

   Lime stabilization of soil leads to

   (i) Decrease in shrinkage limit

   (ii) Increase in plastic limit

   (iii) Decrease in liquid limit

   (iv) Flocculation of clay particles

   Which of the above statements are correct?

   (A) 1,2 and 3   (B) 1,2 and 4   (C) 1,3 and 4   (D) 2,3 and 4

Key: (D)

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Exp: → Increase in lime content causes considerable reduction in swelling pressure and increase in shrinkage limit.

→ Lime stabilization causes flocculation of clay particles.

111. Arrange the following soils with respect to increasing order of realizable friction ratio:

(i) Loose gravel fill

(ii) Sands or gravels

(iii) Clay and mixtures and silts

(iv) Clays and peats

(A) 1,2,3 and 4   (B) 4,2,3 and 1   (C) 1,3,2 and 4   (D) 4,3,2 and 1

Key: (D)

Exp: Most friction will be provided by gravel fill, least by clayey soil.

112. In a 7 m thick soil stratum, with its initial void ratio of 0.40, the void ratio decreases to 0.30 when the effective pressure on the stratum is increased by 1.0kg/cm^2. The consolidation settlement of the stratum will be

(A) 5cm   (B) 50cm   (C) 100cm   (D) 150cm

Key: (B)

Exp:
$$S_C = m_V H_0 \Delta\sigma = \frac{\Delta e}{\Delta\sigma} \times \frac{1}{1+e_0} \times H_0 \times \Delta\sigma$$

$$= \frac{0.1}{1} \times \frac{1}{1.4} \times 700 \times 1 = \frac{700}{1.4} = 50 \text{ cm}$$

113. A footing 1m × 1 m in size rests on the surface of an infinite layer of soil. It is subjected to a load of 600 kN. What is the immediate settlement of the soil by considering Eu = 2.0 MPa, N = 0.5 and influence factor = 0.95?

(A) 22.5mm   (B) 25.5mm   (C) 27.5mm   (D) 30.0mm

Key: (A)

Exp:
$$S_i = qB\frac{\left(1-\mu^2\right)}{E_S}I \Rightarrow \frac{600 \times 10^3}{1 \times 10^6} \cdot \frac{\left(1-0.5^2\right) \times 0.95 \times 1000}{2}$$

$$S_i = 213.7m \Rightarrow 21.37mm$$

114. A stratum of soil consists of three layers of equal thickness. The permeability of both the top and the bottom layers is 10^{-4} cm/s; and that of the middle layer is 10^{-3} cm/s; then the value of the horizontal coefficient of permeability for the entire composite of the soil layer is

(A) 2×10^{-4} cm/s   (B) 3×10^{-4} cm/s

(C) 4×10^{-4} cm/s   (D) 5×10^{-4} cm/s

Key: (C)

Exp: $k_H = \dfrac{k_1 H_1 + k_2 H_2 + k_3 H_3}{H_1 + H_2 + H_3} = \dfrac{10^{-4} + 10^{-4} + 10^{-3}}{3} = 4 \times 10^4$ m/s

115.   Consider the following statements regarding the overflow rate of sedimentation tank:

(i)   Temperature of water affects the overflow rate

(ii)   Size of particle intended to be removed does not affect the overflow rate

(iii)   Density of particle intended to be removed affects the overflow rate

Which of the above statements are correct?

(A) 1 and 3 only   (B) 1 and 2 only

(C) 2 and 3 only   (D) 1,2 and 3 only

Key: (A)

Exp: As temperature decreases, rate of setting decreases.

Rate of setting α d^2 · where d= size of particles

Density of particles affects settling.

116.
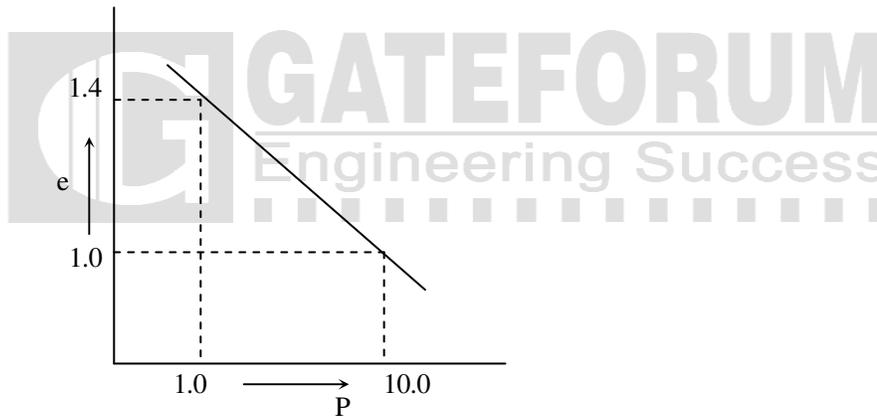
The virgin compression curve for a particular soil is as shown in the above figure on the standard graphical format. The compression index of the soil is

(A) 0.3   (B) 0.4   (C) 0.5   (D) 0.6

Key: (B)

Exp: $C_C = \dfrac{e_1 - e_2}{\log_{10}\left(\dfrac{\sigma_2}{\sigma_1}\right)} = \dfrac{1.41}{\log(10)} = 0.4$

117.   In a triaxial compression test, the major principal stress was 90 kPa and the minor principal stress was 30 kPa, at failure. The pore pressure at failure was observed to be 10kPa. The tangent of the angle of shearing resistance of the sandy soil that was tested was

(A) $\dfrac{1}{2}$ (B) $\dfrac{1}{3}$ (C) $\dfrac{2}{3}$ (D) $\dfrac{3}{4}$

Key: (D)

118.   A cylindrical soil specimen of saturated clay, 3.50cm diameter and 8 cm length, is tested in an unconfined compression testing machine. The specimen failed under a vertical load of 50kg together with an accompanying additional deformation of 8mm. What is the unconfined compressive strength of this clay?

   (A) $4.67 kg/cm^2$ (B) $5.0 kg/cm^2$ (C) $5.5 kg/cm^2$ (D) $6.0 kg/cm^2$

119.   Consider the following statements related to the properties of a good quality soil sample:

   (i) Area ratio should be low

   (ii) Cutting edge should be thick

   (iii) Inside clearance should be high

   (iv) Outside clearance should be low

   Which of the above statements are correct?

   (A) 1 and 2   (B) 2 and 3   (C) 3 and 4   (D) 1 and 4

Key: (D)

Exp: $k_D = k_{20}(1.047)^{T-20}$ depends on (T)

120.   Consider the following statements regarding biochemical oxygen demand (BOD) of river water:

   (i) The BOD rate constant varies with river water temperature

   (ii) The BOD rate constant does not depend on the BOD of the river water

   (iii) The BOD rate constant is often different for different river waters

   (iv) The BOD rate constant cannot be determined in a laboratory

   Which of the above statements are correct?

   (A) 1 and 4   (B) 1 and 3   (C) 2 and 3   (D) 2 and 4

Key: (B)

Exp: BOD rate increases with temperature of river water

$$= K_D = K_{20^o c} \times (1.047)^{T-20}$$